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Growth and Development of Indian Open Access Scholarly Publications: A Bibliometric Assessment

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Abstract: The main purpose of this study is to trace out the growth and development of Indian open access scholarly publications during the period of 1970 to 2020. The data required for this study has been collected through the Lens database and analyzed on the basis of various indicators of bibliometrics assessment. This study showed that India has published a large number of articles (417887) in open access publications. The most significant findings in this study are that India ranks 13th in the world with positive growth, Indian Institute of Science has contributed the most of the papers, dominance of science subjects and RSC Advances Journal has scored the first place. This bibliometrics study revealed that India's contribution to open access publications is undeniable and India has conducted collaborative research with many developing countries around the world.

Keywords: Open Access, Scholarly Publications, Lens database, India, Bibliometric Study.

Introduction: The Budapest Open Access (2002) Initiative defines open access as "free availability on the internet, permitting users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal or technical barriers other than those inseparable from gaining access to the internet itself." Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions (Suber, 2004). Reader can read a scientific document over intranet and print it out and can further distributes for non commercial purpose (Björk, 2004). At present, the popularity of open access publishing has increased in throughout the world (Laakso et al, 2011)). Like the rest of the world, India has been actively involved in open access publishing. Many Indian Universities, autonomous institutes,

research and development institutes have also promoted open access publishing and their researchers have published articles on this platform (Rajashekar, 2003). Several open access initiatives in India played a very important role in popularizing open access and these initiatives have served very well since their launched time (Bist & Mohanty, 2006). Notable among these initiatives are Indian National Science Academy, Indian Academy of Sciences, Indian MEDLARS Centre, National Institute of Science Communication Information Resources and Medknow Publications and others (Fernandez, 2006).

In the past, researchers have done a lot of good research work in India's open access publication and its related areas. Dividing these previous literatures into subcategories wise, Open Access Initiative (Arunachalam, 2009; Sawant, 2009; Singh, 2009; Sing & Nagi, 2011; Roy, Biswas & Mukhopadhyay, 2012), Open Access Publications and their growth (Arunachalam, 2004; 2004; 2006; 2008; 2008; Kirsop, 2007; Arunachalam & Muthu, 2011; Mukherjee & Mal, 2012; Nazim, 2017), Institutional Repository (Ghosh & Das, 2007; Hirwade & Rajyalakshmi, 2006; Nagaraj, Obaiah & Thomas, 2009; Gohain, 2011), India's contribution to the Directory of Open Access Journals (Lone, Rather & Shah; 2008; Nazim & Devi, 2008; Bandi, Angadi & Kademani, 2013; Pandita, 2013; Nashipudi & Ravi, 2014; Singh & Khanchandani, 2015; Mondal, 2016; Sahoo, Mohanty & Sahoo, 2017) etc topics are available. Summaries of these works show that, India has made many contributions to Open Access publications around the world. The current state of institutional repositories in India is at a very good level and these repositories are making proper use of their own scholarly output. India is also well positioned in the works based on indexing and abstracting databases from which it is easily proved that India has also contributed in terms of quality. Similarly, the research works based on the Directory of Open Access Journals and above has also reflected the success stories of India's open access publications. The uniqueness of the current work is that it is based on the Lens database which covers a large number of publications.

Since open access is one of the most important issues at this moment (Harnad & Swan, 2008), it is necessary to study its present status in India, and that is the main purpose of this present work. To accomplish this work, several bibliometric indicators have been used because bibliometric is a research method that can be used to analyze the publication output of any subject (Pritchard, 1969).

Objectives: The main objectives of this study are:

- to trace out the growth of Indian open access publications
- to examined the affiliated institutes attached with these publications and preferred subject areas.
- to find out the most popular source of the publications and the publishers

Methodology: Three methods have been used to complete the present research study i.e. search strategy, data extraction and statistical analysis of collected data. Data has been collected from the Lens database for smooth completion of the current task. The Lens (https://www.lens.org/) is an online free and open access platform where a large number of patents and scholarly work are available. First open access flag is selected from the lens database and 40,957,615 publications are available from there. In the second stage, India is selected from the country tag and the year range is shortened from 1970 to 2020. In the end, this search technique retrieved 4,17,887 papers [Filters: Year Published = (1970 - 2020) Institution Country/Region = (India) Open Access] which is being selected for this present study. Necessary data is then extracted from these selected papers based on the bibliometrics indicators used for this study. The required data is then stored and managed with the help of Microsoft Excel. In the last step of the present work, the data is presented in tabulation form and the final conclusion is drawn based on its analysis.

Data analysis & Findings

Growth of the Literature: Table 1 describes the decade wise distribution of the publications. Researchers in the past have predicted an increase in India's open access publications in their research papers. There is a very positive trend in the growth of India's overall open access scholarly publications. During the year 1970 to 2020, 417887 scholarly works were published, which is quite significant in terms of publication numbers. The number of papers has been increasing since the beginning of the 21st century and in the second decade, since 2010, there has been a huge increase in the publishing trend (Fig 1). The linear and exponential trend line of year wise publication growth also reflect the same equation.

Table 1: Decade Wise Distribution of the Publications

Decade	Publications	Percentage
1970-1980	4111	0.98
1981-1990	6752	1.62
1991-2000	17269	4.13
2001-2010	66631	15.94
2011-2020	323124	77.32
Total	**417887**	**100**

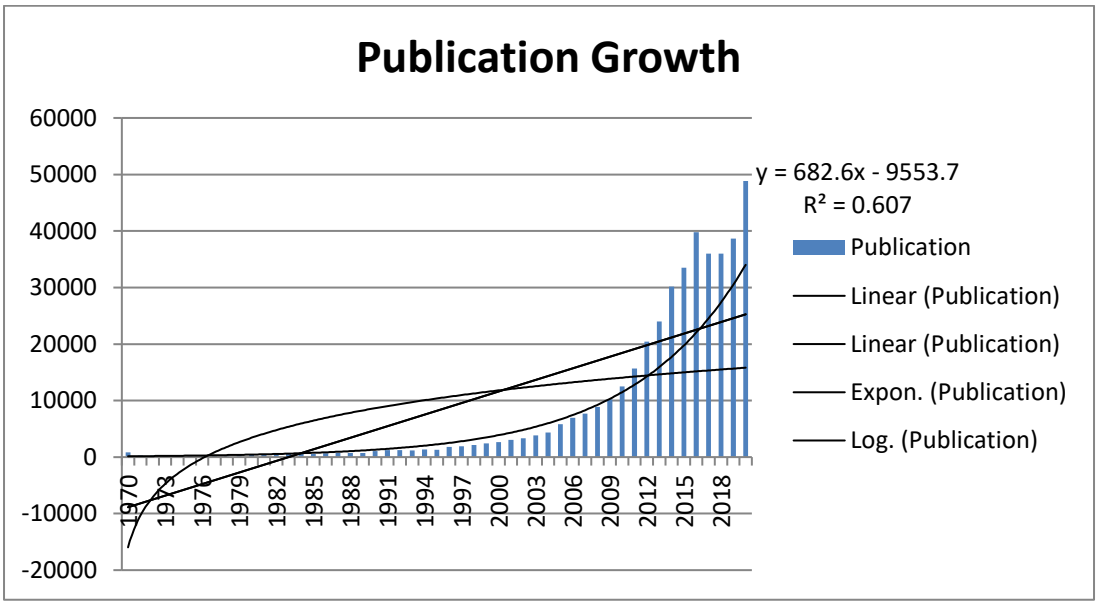

Fig 1: Year Wise Distribution of the Publications

Global Scenario of Open Access: Table 2 shows the most productive countries in open access publishing around the world. This list shows that the progressive and developed countries of the world have made significant contributions to open access publications. The United States topped the list with the most papers (13.20%), followed by the United Kingdom (4.01%), China, Japan, and Germany, respectively. But it is clear that the United States has published three times as many articles as the United Kingdom, which ranks second on the list. This means that the United States is far ahead of the rest of the world in terms of the open access publications. It is also significant that India ranks 13th on the list with only 1.02% of the world's open access

publications. Apart from India, among the Asian countries, China ranked third on the list with 3.36% of the publications, followed by Japan (2.59%) at fifth.

Table 2: Most Productive countries in open access publishing

Country Name	Publication	Percentage	Rank
United States	5405982	13.20	1
United Kingdom	1643706	4.01	2
China	1376540	3.36	3
Japan	1061955	2.59	4
Germany	972932	2.38	5
Brazil	816552	1.99	6
Canada	673741	1.64	7
France	561918	1.37	8
Australia	561711	1.37	9
Italy	560433	1.37	10
Spain	548071	1.34	11
Netherlands	434513	1.06	12
India	417887	1.02	13

Most Productive Institutes: table 3 describes the most productive institutes of India. Analyzing the aspects of institutional contribution, it is seen that prominent institutions of India have got a place in this top ranking list. The list of top institutions ranges from top universities in India to IITs, medical sciences and basic R&D Institutes. From the list of these organizations, it is understood that well-known organizations in India have actively come forward in open access publication. Institutionally, Indian Institute of Science (IISc), Bangalore (4.20%) has published the most papers. Also on the list there are some notable institutions like All India Institute of Medical Science and Indian Institute of Technology.

Table 3: Most Productive Institutes

Institution Name	Document Count	Percentage
Indian Institute of Science	17566	4.20
All India Institute of Medical Sciences	17044	4.08
Post Graduate Institute of Medical Education and Research	11633	2.78
Tata Institute of Fundamental Research	10128	2.42
University of Delhi	7779	1.86
Indian Institute of Technology Bombay	6887	1.65
Government Medical College, Thiruvananthapuram	6411	1.53
Council of Scientific and Industrial Research	6308	1.51
Indian Institute of Technology Madras	6127	1.47
Panjab University, Chandigarh	5484	1.31

Subjects: Fig 2 shows the top ten highly trusted subject areas of these publications. These subject keywords are expressed through subject tag in the Lens database. It is clearly visible from the most trusted research area list that, all subjects belong to the science and its related areas. Significantly, like previous research studies, this work also shows that science dominates in India's open access publications. Among the subjects, medicine (30.50%) has taken the first place and then biology, chemistry and materials science are in the list.

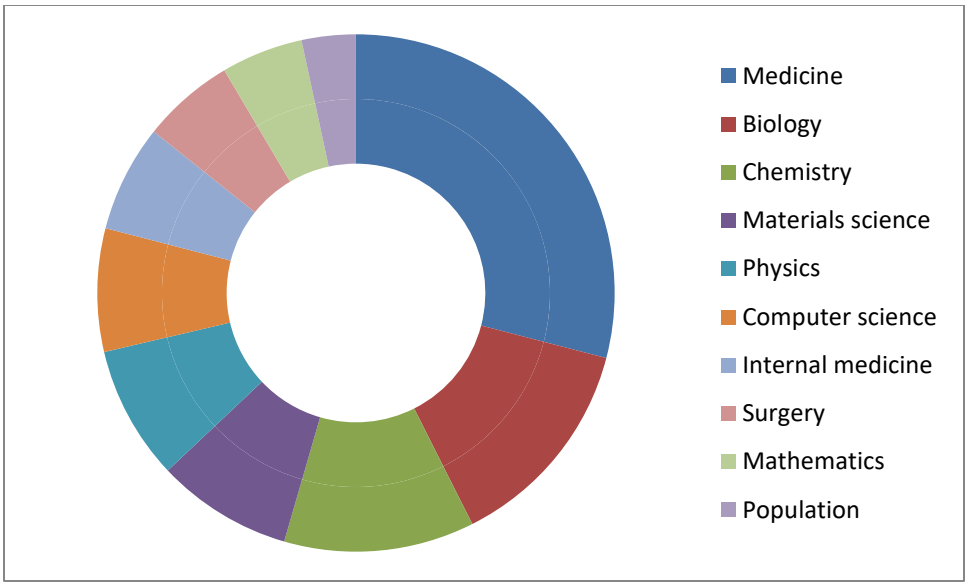

Fig 2: Top ten highly trusted Subject areas

Publication Source & Publisher: Table 4 shows the most preferred source of publications. An important parameter of quality analysis of a research paper published on a subject is the source of publication or publisher of the article. From the table 4 it is clear that the research papers of Indian scholars have been published in famous open access journals all over the world. It is also noteworthy that the participation of Indian journals is similar to that of foreign journals, which means that India is also moving forward with equal pace in open access publishing. Among the journals, RSC Advances (6132) occupies the first place in the list with the most articles, followed by PloS One (4416), Acta Crystallographica Section E Structure Reports Online (3869) and Scientific reports (3762) respectively. Needless to say, since source journals are well-known, their publishers will naturally be well-known and here, along with the world's largest publishing house, there are also publishers from India (Table 5). It is easy to predict from the activities of India's major publishing houses that India's position in open access publishing will increase further in the next decade.

Table 4: Most preferred Source of Publications

Source Title	Document Count	Percentage
RSC Advances	6132	1.47
PloS one	4416	1.06
Acta Crystallographica Section E Structure Reports Online	3869	0.93
Scientific reports	3762	0.90
Indian Journal of Science and Technology	3411	0.82
The Indian journal of medical research	3362	0.80
Journal of clinical and diagnostic research : JCDR	3124	0.75
Indian journal of experimental biology	2863	0.69
Indian journal of ophthalmology	2858	0.68
BMJ case reports	2781	0.67
Bulletin of Materials Science	2543	0.61
Physical Review D	2542	0.61
Procedia Computer Science	2483	0.59
Physics Letters B	2396	0.57
Monthly Notices of the Royal Astronomical Society	2294	0.55
Indian journal of pathology & microbiology	2237	0.54
IOP Conference Series: Materials Science and Engineering	1958	0.47
Indian journal of psychiatry	1839	0.44
Journal of High Energy Physics	1754	0.42
Physical Review B	1713	0.41

Table 5: List of Publishers

Publisher	Document Count	Percentage
Elsevier	46234	11.06
Medknow Publications and Media Pvt. Ltd	36984	8.85
Springer Nature	29658	7.10
Medknow	16662	3.99
Wiley	11555	2.77
Royal Society of Chemistry (RSC)	8000	1.91
Springer India	7501	1.79
IOP Publishing	7446	1.78
American Physical Society (APS)	7381	1.77
BioMed Central	5836	1.40

Collaborative Countries: Table 6 describes the collaborative countries. Many countries around the world have worked collaboratively with India, whose overall research standards are currently world leading. As the quality of research in India for this collaborative research work has increased, so has the number of publications. Among the countries, United States (9.46%) occupies the highest position, followed by United Kingdom (4.13%), Germany and China. In addition to China, there are two Asian countries on the list i.e. Korea and Japan in the eighth and ninth place respectively.

Table 6: Collaborative countries

Institution Country	Document Count	Percentage	Rank
United States	39546	9.46	1
United Kingdom	17253	4.13	2
Germany	11521	2.76	3
China	8252	1.97	4
France	7523	1.80	5
Italy	7213	1.73	6
Australia	7146	1.71	7
Republic of Korea	6911	1.65	8
Japan	6497	1.55	9
Canada	5851	1.40	10

Discussion on Findings: Data analysis of this paper has revealed some important findings that can be easily followed in keeping with the previous research works. From 2011 to 2020, the most articles have been published in this decade, which is more than three-quarters of the total publication in number. The world's leading nations, such as the United States and the United Kingdom, have taken the lead in publishing open access around the world, which agrees with several previous works (Singh & Khanchandani, 2015). Collaborative research has also shown that the research articles of Indian scholars have been published with these countries. However, the study shows that India is not far behind other countries in open access publications, as India ranks 13th in the world and 3rd in Asia. Several previous works has shown that a number of institutions in India encourage and promote open access publications with their initiatives (Bist & Mohanty, 2006; Sawant, 2009; Singh, 2009; Singh & Nagi, 2011) so those institutions have contributed the largest number of papers. This is clear from the contribution of open access from notable education and research institutes like Indian Institute of Science, All India Institute of Medical Sciences, Tata Institute of Fundamental Research, Indian Institute of Technology that these institutions place considerable importance on open access. It is also clear from the analysis, that if India develops an open access policy or framework for whole country (Rajashekar, 2003;

Arunachalam, 2008), then India will be in a better place in the world in open access publications. Among the most trusted subjects, science subjects, especially in the areas of medical sciences (Mukherjee & Mal, 2012; Singh & Khanchandani, 2015), are very dominant which directly indicates the success of Indian Council of Medical Research. Analysis shows that India's Open Access publications have been published in world and India's leading journals. India, like the rest of the world, has published many journals, so that scholars from other countries can publish their writings in addition to meeting the demand for domestic publications in the country. The current work is based on the Lens database which is a limitation of this paper. This work can be further extended later with the data from world leading indexing, abstracting or citation databases, such as the Web of Science or Scopus.

Conclusions: The way in which India has made its name as one of the world's leading contributor in open access publications is very much commendable. India has occupied 13th rank in the world, which means that India's contribution to open access publications is highly acceptable. The overall growth of India’s open access scholarly publishing is very satisfactory in terms of publication number. It is highly creditable that India's renowned educational and research institutions have come forward in open access publications. This study also shows that the science department dominates the publications and research papers published in reputed journals. India has also conducted joint or collaborative research with various countries in the world and published its output on open access platforms. As a result, these research papers will be easily accessible to the whole world and more new aspects of research will be unveiled in the future. Positive indication was obtained from all of the parameters such as growth and source of publication, on which the present work was based. In this case, if organizations take the initiative to promote open access such as orientation programmee, workshop, seminar etc., then the academic community will get more research papers. Library and library information science professionals need to take a more pioneering role in this work so that their institutions move forward. In the end, it can be said that a bright future awaits India's open access publications.

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